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SCIENCE AND TECHNOLOGY IN THE BRITISH PRESS: 1946 TO 1986[1]

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Longitudinal content analyses of Science coverage in the media are expensive, laborious and therefore rare. None of the existing studies covers the entire Post-War period. We are constructing a *cultural indicator for Science* in Post-War Britain. The newly established Media Monitor Archive at the Science Museum, London, will contain around 10,000 press articles on science news in daily newspapers. The collection is systematically drawn from a cross section of the British national press between 1946 and 1986. Articles are coded on 70 variables. Variables refer to *formal characteristics* (e.g., size, illustrations, headline, citations, news section, and ratings on personalization or story tone) and to the *structure of the news narrative*: Who is the author? Who is the main agent? What is the event, and where (research involved, time horizon, locality)? What is the context? What are the consequences for whom? What is the moral of the story? These indices will allow us to create time-series data to characterize a) the cyclical nature of science coverage; b) the changing structure of science news stories; c) the differences between quality and popular newspapers in various aspects; d) the varied ways in which different areas of science and technology are covered. Initial results show the cyclical nature of science coverage and differences in that cycle between quality and popular newspapers over 40 years in British daily and national press.

According to Hilgartner's (1990) observation of observers popularisation of science is based on a twofold distinction: genuine knowledge versus popular knowledge, and adequate versus distorted popularisation. Within the dominant hi-fi model of communication one attributes the deviation between source intention and audience effects either to the incompetence of the source, the journalist, or to the resistance and ignorance of the audience (Dornan, 1990). Inadequate as this is, these distinctions allow scientists to maintain their own authority in matters of their subject, and to control the images of their activity in public. For the purpose of research it seems more adequate to classify the various channels of communication as a continuum on which the distinction between genuine and popular is movable and a matter of standpoint.

It is ironic to see how scientists maintain a culture of complaints about the media without much empirical evidence beyond the feeling of being badly served. For many a scientist to make public claims seem to require sound evidence. The question arises, why should the media treat scientists differently from politicians, businessmen, judges or priests; to the contrary the media follow their own logic and treat different issues similarly (Neidhardt, 1993).

The "public understanding of science and technology" is an area of activity to further the cause of science among the wider public *and* it is an area of research to explore the complex interface of science and the public, being at the same time reflection, evaluation and guidance for the former. Several empirical topics have emerged over the years: research on public knowledge of and attitudes to science and technology (Miller, 1983; Durant *et al.*, 1989; Bauer *et al.*, 1994); participant observation studies in technological controversies (e.g. Wynne, 1993); media analyses (e.g., Nelkin, 1987; Schiele and Jacobi, 1989; Lewenstein, forthcoming); sociological and historical studies of popularisation activities (Shinn and Whitley, 1985 general; Lewenstein, 1992 for the USA; Raichvarg and Jacques, 1991 for France).

In this context the Science Museum Media Monitor Project undertakes to characterise the coverage of science in the British national and daily press over the whole Post-War period. The project has the following aims: first, to construct a cultural indicator of public science for Britain – logically this will constitute an explanandum; second, to analyse the variation in the structure of science and technology coverage across time and different papers; third, to relate the fluctuations of overall coverage and of the structure of coverage to the wider contexts of editorial history of the national press, economic indicators, and science policy issues; fourth, to establish an archive of representative source material for teaching and further research.

I shall briefly review three studies with a similar scope of analysis to situate our own project before describing some technicalities of the media sample and its analysis; and finally I shall present some preliminary results on the press coverage of science in Britain 1946-1986.

1 Longitudinal content analysis of science in the media

Content analysis is a standard quantitative method of the social sciences (Krippendorff, 1980) to analyse written material such as books, documents, newspapers, or transcripts of radio and TV programmes. The method is **unobtrusive –** the data is not influenced by the collection process. However the distinction between quantitative and qualitative methods is an unfortunate one. It is difficult to see how anything can be measured without making qualitative distinctions. We see content analysis as an approach to textual analysis among others (Lindkvist, 1981). In general, textual analysis deals with the triangle of producer, text and audience, and provides an interpretation of that relationship.

The adequate interpretation of texts is an ancient problem originating in the interpretation of "holy" religious scriptures. Between the Skylla of textual fundamentalism of reading the text literally and the Carybdis of "metaphysics" without reference to the text, the notion of a *text model* allows us to work without making final claims on the content. In contrast to hermeneutics or semiotics which tend to increase complexity – a single sentence may give rise to whole libraries of artful and scholastic interpretation – quantitative content analysis reduces complexity in a well-defined way. Increase and reduction of complexity are complementary processes, either in parallel or in temporal sequence.

Most analyses of science in the media deal a) with snap shots of a relatively short time period; b) with in-depth analysis of typical examples of the genre; c) with a particular topic such as "Darwinism", "environment", "the atom", or "biotechnology" over an extended period of time; or d) with a particular topic such as "cold fusion" as the story breaks in through various channels of communication.

Longitudinal studies of science media coverage which present the large picture *and* long time horizon are few. We found only three studies attempting to characterize the entire science coverage in the media over a period of 10 years and more: for the USA between 1910 and 1955 (LaFollette, 1990); and for Germany between 1965 and 1985 (Kepplinger *et.al.*, 1989); and for Australia between 1980 and 1990 (DITC, 1991). These studies, albeit with different material and categories, set an agenda to present the large picture of science in the media in a secular trend. We analyzed these studies, found them interesting and deficient in various ways, and improved our own efforts.

LaFollette (1990) analysed a sample of US American weeklies, family, literary and political magazines between 1910 and 1955, the period before the Sputnik shock. She took a 40% stratified random sample of all issues and selected from these issues 687 articles over a period of 45 years, or 15 articles per year. She has analyzed the style of presentation, authorship, the type of article, image of the scientist presented (magician, expert, creator, hero), limits put on science, types of critical messages, and the scientific fields covered. The coverage being fairly stable at index point 20, a strong peak occurs in the mid 1920s, an increase to point 70, to fall off soon after to normal level. Coverage raises continuously after 1945. LaFollette's sample is too small to make more specific cross tabulations, such as the image of the scientist for different fields of study, the type of article or the tone of the message.

Kepplinger and his team coded around 48,000 statements on science and technology in a sample of German daily and weekly press between 1965 and 1985.[2] As units of analysis they use statements instead of single articles as most studies do. Statements are coded on 61 variables. The sample is drawn from the political part of newspapers – normally the first 4 pages for daily and all political commentary from weeklies – every year and from other parts every five years. Time series data of coverage showed no correlation with external data on levels of water pollution and levels of radioactivity. Kepplinger concluded that the rapid expansion of science and technology in the political press after 1975 with a simultaneous increase in negative coverage is not a reflection of "real" events and founded concerns; hence the title of the book "artificial horizons". In the tradition of German "Kulturkritik" he quasi locates a "conspiracy" of 1968 activists. This generation constitutes a new "reflective elite" which confronts in a two-culture model the scientific and technical elite in Germany. This new generation of political editors of the German press have progressively undermined the popular belief in progress through science and technology.

This did not stay without contradiction, not least from science journalists themselves (Haller, 1991). Because of the controversial interpretation of the data much criticism focused on the methodology of the study and brought to the light a number of deficiencies of the Kepplinger approach. First, the study is insufficiently documented to fully understand the details of their methodology. Secondly, the study gives only a partial picture of the coverage of science and technology in Germany between 1965 and 1985, namely the picture painted in political commentary – the first few pages of the newspapers – which is biased towards the negative by its nature; it may look different when taking into account the whole science coverage. Third, the choice of unit of analysis poses a problem. On average 9.5 evaluative statements were coded per article. It is unknown how these statements relate to each other – consonant, dissonant, or balanced within a single article. Therefore the data is more an indicator of the richness of evaluative statements in political commentary, than of conclusive directions. Wherever this debate may lead, Kepplinger's study has put the need for a comprehensive study of media coverage of science firmly on the agenda.

The Australian science indicator report includes a quantitative analysis of the public's exposure to media science (DITC, 1991). The methodologically rather basic press analysis covers the years 1980 to 1990. A sample of constant two weeks over this period shows a fourfold increase of coverage from 50 articles in 1983 to 200 articles in 1989.

For the present purposes I want to highlight the following results of studies of science in the media:

- Most of science coverage does not appear in a special news section "science and technology", rather in sections on crime news for genetic finger printing, consumer information for food engineering, political debates, economic and business reporting on various technologies, and cultural pages, for example on AIDS. The scientific culture is meshed with various types of news. Hence, the criteria to define science news needs to be wide and open.

- The news value of science is determined by various factors, least of which the scientific events themselves. Many topics peak in coverage at times that have no immediate relation to scientific events. The frequency of coverage is more likely related to public themes, debates and issues. Press coverage of science and technology is a phenomena which may reflect political rather than scientific events.

- At present, most coverage of science in the media concerns medical and health issues. Most comparative studies show the dominance of health and medical issues with variable percentages in different contexts. However, it is unknown whether this was the case in the past; rising concerns for personal health may have replaced other scientific concerns in the news.

- In the British context, Hansen and Dickinson (1992) showed that radio, TV and newspapers do not differ significantly in the structure of scientific content in 1989; they differ, not surprisingly, in the mode of presentation. This result is reassuring for our own study; newspaper coverage seems to be a reliable indicator of general media coverage of science in Britain.

- Over longer time periods science and technology coverage fluctuates strongly. The coverage of science and technology in the press explodes in Germany after 1975 and in Australia after 1983. Some significant change in the secular trend seems to occur. The question is when does it happen in different contexts, and why?

- Our understanding of “science” is continental European and includes the social sciences and the humanities in the sense of any critical endeavour that is methodologically reflected.

2. The Science Museum Media Monitor Project 1946-1986

I present briefly our sampling procedure and the coding frame which comprises a number of ideas. We attempted to construct a coding frame that is both theoretically sound (top-down reasoning) and empirically grounded (bottom-up observations).

2.1 The media sample

To do historical media analysis one needs to rely on adequate archives. To include TV in the study proved too difficult from the point of view of the archival situation, and also because of the technicalities involved in viewing and analysing historical TV programmes. However, the British Library Newspaper Archive at Colindale keeps every daily and weekly British newspaper back to the early 19th century mostly on microfiche and as hard copy. For the period after World War II we are well served with this stock of material. To be able to construct a stable cross section of material we confined ourselves to the daily press. Based on some pilot work we estimated that up to 700,000 relevant articles constitute the population of our analysis:

> Press articles on science and technology in the British national press on weekdays between 1946 and 1986.

We confined the project to this period for two reasons. In 1985 the Royal Society launched its report on the Public Understanding of Science in Britain, which changed the context of public science. The data collection after 1986 poses very different problems, as many of the papers, at least the qualities, become available on electronic data bases (Hansen, 1982), making the collection cheaper but the selection more difficult.

The selection process of material follows three steps: first a cross section of newspapers is defined, random dates are generated, and finally relevant articles are selected from the newspapers on dates indicated by the random list and archived for further analysis.

In creating a time series of material one faces the dilemma of homogenising an unstable context without distorting excessively. This may not be easy if newspapers come and go, change ownership and readership as well as political orientation over a period of time. The British press went through three major upheavals at the end of the 1950s, at the end of the 1960s and in the 1980s. The readership of morning newspapers has remained stable at about 15 millions throughout the Post-War period, while a tripartite press market collapses into a dichotomous market of quality and popular papers (Tunstall, 1983).

We chose four sampling criteria: circulation, readership, popular and quality press, and opinion leadership. Our sample contains on the quality side the broadsheet papers *Daily Telegraph* and *Times*, on the popular side the tabloid papers *Daily Express*, *Daily Mirror* and the *Sun*. The *Daily Telegraph* and the *Daily Mirror* are the relatively stable papers and form two series over the whole period; the *Times* loses its opinion leadership position in the second half of the 1980s to *The Independent*.[3]The popular press is represented by the *Daily Express* until 1974 and replaced by the *Sun* from 1976 to 1986.

For each newspaper we generate 10 random weekdays per year. To date we collected every second year: 1946, 1948, 1950, etc., and confined ourselves to weekdays, because the market of Sunday papers and of weekly magazines is most unstable. We intend to sample Sunday papers in a statistically comparable way. From 1946 to 1986 we sampled 21 years, four newspapers over 10 days each cover a total of 840 days and produce around 5,500 articles.

The unit of analysis are individual articles, in contrast to Kepplinger's study, where they analysed single statements. Articles are selected according to three main criteria. First, we do not make a distinction between natural science, humanities or social sciences. We included history, archaeology, economics, social statistics, psychology, but excluded corporate news and items that have regularity such as weather reports, astrology columns, or stock market. Secondly we take it that "science and technology" comes into newspapers at various places and forms, and special science sections are a later innovation, hence we cannot confine ourselves to special sections analysis. The distribution of coverage in the different sections of newspapers or types of news is rather an interesting empirical question. Thirdly, we take it that science and technology as culture does not only come in what scientists or engineers would recognise as an article about their subject matter, but in scientific and technical presentations using jargon, technical words or scientific authority. Particularly in the popular press we would have to consider as relevant articles that refer to "scientific authority" whatever the main theme of the article may be. Selections of that kind include decisions that cannot be entirely explicated; we have controlled the reliability of our selections, and reached acceptable levels of explication after various discussions; however the problematic of any such decision cannot be avoided.

To date the archive contains around 5,500 articles published between 1946 to 198 inclusive. At point of selection every article is “primary coded”. Information that gets lost by taking it out of the context is recorded on a coding sheet. This includes information about the newspaper section, the date, the size of the whole newspaper, page number, folder, location on the page, etc. The collected articles are finally kept in transparent files, sorted by year and newspaper. The archive will be open for research purposes sometime this year.

The main coding endeavour, by which we will be able to characterize form and content of science coverage in Post-War Britain, is to about 80% completed. The data will be computerized for statistical analysis. This data basis will assist in tracing particular materials for further analysis. However, the coding is constructed for content analysis and not as an index for the purposes of archiving and user access.

2.2 The coding frame: science news as narrative

I mentioned that we distinguish the primary coding with 11 variables, to keep information that would otherwise be lost by decontextualising the articles, and secondary coding, the main content analysis frame. The secondary coding frame consists of 59 variables. Each article is read, explored with 59 questions, and given a code on each of these variables.

We use four types of variables. Dichotomous, nominal, ordinal, multiple and string variables. Dichotomous variables are basically questions of yes/no or present/absent; nominal variable are categories such as “scientific field“, “type of newspaper story”, or “geographical location” where we classify an article as being of only one kind. Variables such as “geographical location of the event” have as many as 100 possible values, basically most of the world’s countries. Ordinal variables are rating scales, where we ask the coder to judge an aspect of the article in a manner of more or less such as “personalisation”, “how scientific is the style of the article”, “evaluative tone”, etc. We use semantic differential to record a “character profile of the main actor.”[4] For some variables such as “news values” we allow for multiple codings. We record the name of the author, a string variable, which allows us to analyse profiles for some individual authors.

The development of a category system is a process of reduction of complexity that is guided both by the material at hand, and by theoretical ideas and interesting questions. For the development of the coding frame we incorporated ideas from previous media studies and developed our own. Extensive piloting through several versions of it were necessary until it reached a workable structure and the level of explication that new coders need to understand what to do. The coding frame is intended for wider applications and will be available in due course.

The construction of the category system is both top-down, incorporating conceptual ideas, and bottom-up, accommodating the resistance of the material. The following top-down ideas underlie the category system. We analyze various devices that are used to *structure the attention* of the potential reader, such as illustrations, headlines, summaries, inserts, etc. We regard a newspaper article as a story. The idea of a narrative is a heuristic to lead us to identify a narrator, an agent, an event, conditions or background agents, consequences, and the moral of the story. For each of these elements of the narrative we defines a number of variables. We distinguish the main narrative, which may be a scientific one or not, and the scientific subnarrative, in cases where the main narrative is of a different kind.

For the analysis of *agents* we distinguish levels of agency: material, individual, informal social groups, institutions, and national and international agents. We distinguish "political", "cultural, educational and religious", "economical" and "scientific and technical" domains of agency which characterize the differentiation of modern societies. To characterise agency we define a module of variables that is used in coding the background as consequences and moral of the narrative.

For example, *events* are characterised by whether the story presents an invention, an innovation or the market diffusion of some method or product; what scientific field is involved, the national location of the that event, the time horizon of the story into the past and into the future. This allows to show the variety of contexts scientific references are made.

To characterise the *background* of an event we are again interested in the kind of agent involved. With the same module that we use to characterise the main agent, we can characterise the background agent, who is often very different from the agent of the story.

With regard to *consequences* we distinguish the costs and benefits, and the kind of agency that is affected by either costs or benefits.

The *moral* of the story we characterise with two variables. The first is a rating scale where the coder judges the call for action that the narrative presents between the polarities of active resistance to active support for an event. This may or may not be found in the story. Furthermore we characterise the agency to whom this call is directed.

With this coding frame we can overcome one of the major difficulties in previous studies: the incompatibility of classifications of science from the media point of view and from the scientific point of view. Each article is classified on two dimensions: the type of media story (environment, health, business, politics, women, arts, defense etc.) and the scientific discipline that is referred to (biology, physics, chemistry, geology, engineering, social science etc.). Media and science are different areas of activities and are likely to categories issues in a different way. To impose one category system on the other seems to be neither practical nor particularly enlightening.[5]

At different stages of the analysis we conducted reliability checks, both for the selection of articles and the coding of content. We take reliability as a process indicator; it shows us which categories are difficult to agree on, and it shows the progress of the coder training. Reliability problems are overcome either by dropping the weaker categories, by clarifying the definition of categories, or by increasing the training of coders. However, in content analysis we may be facing a reliability-validity dilemma. On the one hand, a simplistic coding frame yields reliable codes, but a most uninteresting account of the text; on the other hand, a complex coding frame yields an interesting account of the text, but it may be difficult to reach high levels of reliability.

3. Some preliminary results

To date, about 80% of the coding has been completed, but the data allows us to achieve a preliminary picture of the main development in newspaper science after 1946. The overall picture of science coverage is presented in Figure 1 for the quality and the popular newspapers. The figure shows the number of articles sampled every second year by newspapers. This allows us to make some general observations as guidelines for further inquires.[5]

Insert Figure 1: Overall coverage 1946-1986

First, the coverage of science fluctuates considerably. The overall peak of coverage is in 1962 for the *Telegraph*, in the mi-1980s for the *Times*. The peak of coverage differs for quality and popular newspapers. Popular papers present most science stories in the mid-1960s and in the late 1970s. Second, it seems adequate to distinguish four periods since 1946. Until about 1954/56 coverage is low, except for the *Telegraph* that shows a steady increase between 1946 and 1954. Between 1956 and 1962 we find considerable expansion of coverage, both for the quality and the popular press. Between 1962 and 1976 we find a period of relative decline in science coverage, to take off into another rise after 1976, accentuated for the *Times*, more slowly for the *Telegraph*. Third, quality and popular press have a different cycle. The popular press peaks in 1966 and 1968 when the quality press, particularly the *Telegraph* is at its low. The increase of coverage in the 1980s takes place in the quality but not in the popular press. The differentiation between quality and popular press seems most accentuated in the 1980s. Fourth, the quality press differs among itself. While the coverage of events in late 1950s was dominated by the *Telegraph*, the take-off in the 1980s was dominated by the *Times*. Fifth, until the 1950s there seems to be little difference in the intensity of coverage of science between the quality and the popular press, which is particularly true for the *Telegraph* and the *Mirror*.

These observations raise questions as to what may explain (a) these overall fluctuations, and (b) the sometimes synchronous and at other times dissociated development of quality and popular press. The differences between the newspapers, such as *Telegraph* and *Times*, within the general trend may reflect particular editorial policies and practices.

Insert Figure 2: Frontpage news 1946-1986

Further evidence about the significance of public science is shown in Figure 2, which shows the number of front page items for the *Telegraph* and the *Mirror* from 1946 to 1986. It is clearly shown that science front-page news reaches a peak in the beginning of the 1950s which is not attained again in later years. From 1952 onwards we find a downward trend of front-page science news in the *Telegraph*, with temporary recoveries in 1956, 1964, 1972 and 1986. The *Mirror*, the popular paper, goes through two cycles. Front-page news allocated for science in the *Mirror* peaks in the late 1940s and in 1972. In 1956/1958 and 1982 our sample does not contain any front-page news. Science in Britain has lost and never recovered its position as front-page news in the quality press which it held for a short period at the beginning of the 1950s.

Needless to say that these data represent only overall frequencies, hence the intensity of science coverage. The picture is not complete until we are in a position to characterise the qualitative content with the various categories which we code. We hope to be soon in a position to characterise the history of British Post-War newspaper science, at least from the point of view of its output, with a distinct and differentiated picture. Once the archive is established, it will be publicly accessible and lend itself to in-depth studies of the historical changes in the coverage on particular topics, not with a view to analysing a particular coverage in its entirety, but with a view to identifying significant changes over time.

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Endnotes

1. The Science Museum and the Welcome Trust for the History of Medicine are funding this project from 1992 to 1995. Funding was secured under the name of John Durant. Such an ambitious project cannot be done by a single person alone. At the London School of Economics, Department of Social Psychology, we formed a core group with A. Allansdottir, A. Ragnarsdottir, A. Rudolfsdottir ("the Iceland connection"); other research assistants come and go in the course of the project: Jane Gregory, Laura Mello, Cornelia Kuster, Shaheen Sheik, Ann Gosling, Alison Goddard, Gareth Mitchel, and Titan Hancock.
2. Kepplinger's project was funded by the German Government with around 100,000 £ ($150,000) and employed up the 25 researchers at various times. The costs of such a project may explain why there are so few of these ambitious analyses.
3. The British Library replaced the *Times* by the *Independent* as leading London newspaper.
4. This is an idea we take from Ruhrmann's analysis of biotechnology in the German press (Ruhrmann *et al.*, 1992).
5. An example of the confusion that occurs if we do not make such a distinction can be found in a recent cross-sectional analysis of British science coverage. The authors excluded most of the news on "environmental section"

because they did not cover much environmental science, but rather social scientific arguments. Such normative arguments from the perspective of “genuine science” do not further our understanding of media science. The media category “environment” and the scientific category “environment” an not the same, indeed, but we may want to know how the media “environment” is constructed.

6. These data are not weighted by the general total increase of news items during that period. Newspapers have become thicker over the last 50 years. We will have to weight science coverage against the fluctuations of the total size of newspapers. This will most likely increase the relative coverage in earlier years and decrease the coverage in later years, thus rather enhance the trend that we observe.